GEORGIA INSTITUTE OF TECHNOLOGY — OFFICE OF CONTRACT ADMINISTRATION

PROJECT ADMINISTRATION DATA SHEET

[X] ORIGINAL [ ] REVISION NO. ____

Project No./(Center No.) E-25-681 (R6268-0A0) GTRC/GIT DATE 2 / 25 / 87

Project Director: R. M. Nerem School/~~ME~~ ME

Sponsor: National Science Foundation

Agreement No.: Grant No. INT-8796216

Award Period: From 1/1/87 To 1/31/88 (Performance) 4/30/88 Reports

Sponsor Amount:	New With This Change	Total to Date
Contract Value: $		$ 2,100
Funded: $		$ 2,100

Cost Sharing No./(Center No.) E-25-339 (F6268-0A0) Cost Sharing: $ 217

Title: Arterial Fluid Dynamcis

ADMINISTRATIVE DATA — OCA Contact John B. Schonk

1) Sponsor Technical Contact:

Warren E. Thompson
National Science Foundation
STI/INT
Washington, DC 20550

2) Sponsor Issuing Office:

H. D. Wolff, III
National Science Foundation
DGC/STI
Washington, DC 20550

Military Security Classification: ____ ONR Resident Rep. is ACO: ____ Yes ____ No

(or) Company/Industrial Proprietary: ____ Defense Priority Rating: ____

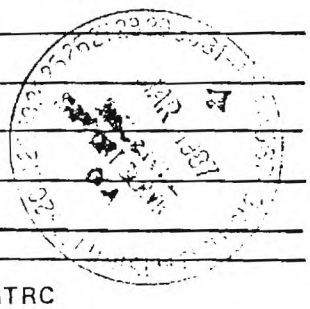
RESTRICTIONS

See Attached NSF Supplemental Information Sheet for Additional Requirements.

Travel: Foreign travel must have prior approval — Contact OCA in each case. Domestic travel requires sponsor approval where total will exceed greater of $500 or 125% of approved proposal budget category.

Equipment: Title vests with GIT

COMMENTS:



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SPONSORED PROJECT TERMINATION/CLOSEOUT SHEET

Date 8/12/88

Project No. E-25-681 School/~~Lab~~ ME

Includes Subproject No.(s) N/A

Project Director(s) R. M. Nerem GTRC/~~GTI~~

Sponsor National Science Foundation

Title Arterial Fluid Dynamics

Effective Completion Date: 1/31/88 (Performance) 4/30/88 (Reports

Grant/Contract Closeout Actions Remaining:

- [X] None
- [ ] Final Invoice or Copy of Last Invoice Serving as Final
- [ ] Release and Assignment
- [ ] Final Report of Inventions and/or Subcontract:
  Patent and Subcontract Questionnaire sent to Project Director [ ]
- [ ] Govt. Property Inventory & Related Certificate
- [ ] Classified Material Certificate
- [ ] Other

Continues Project No. Continued by Project No.

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NATIONAL SCIENCE FOUNDATION
Washington, D.C. 20550

FINAL PROJECT REPORT
NSF FORM 98A

PLEASE READ INSTRUCTIONS ON REVERSE BEFORE COMPLETING

PART I—PROJECT IDENTIFICATION INFORMATION

1. Institution and Address	2. NSF Program	3. NSF Award Number
Georgia Institute of Technology	International	INT-8796216
	4. Award Period: From 1/1/87 To 1/31/88	5. Cumulative Award Amount: $2100

6. Project Title

Arterial Fluid Dynamics

PART II—SUMMARY OF COMPLETED PROJECT *(FOR PUBLIC USE)*

The flow of a non-Newtonian fluid through a system of branching elastic tubes is a problem which presents much of the basic complexities of fluid mechanics. It is also a problem of interest in understanding the role of fluid mechanics in coronary artery disease. The primary objective of this project was to construct flow casts of human coronary arteries so that model studies simulating coronary blood flow could be conducted in realistic, elastic tubes. The total scope included conducting laser Doppler anemometer measurements of pulsatile flow velocity patterns in such model coronary blood vessels. The flow casts were constructed in collaboration with Professor Dieter Liepsch and his laboratory group in Munich, Federal Republic of Germany. These flow casts were made from human anatomical casts made post-mortem by Dr. W.A. Seed in London, England. As a result of one trip on this project to Munich, the technique as applied to human coronary casts was developed. To date two flow casts have been fabricated and two others are under construction. This fall experimental studies will be initiated using these flow casts. These studies should lead to a better understanding of the dynamics of pulsatile flow in elastic tubes like those in the human coronary system.

PART III—TECHNICAL INFORMATION *(FOR PROGRAM MANAGEMENT USES)*

1. ITEM *(Check appropriate blocks)*	NONE	ATTACHED	PREVIOUSLY FURNISHED	TO BE FURNISHED SEPARATELY TO PROGRAM	
				Check (✓)	Approx. Date
a. Abstracts of Theses	X				
b. Publication Citations	X				
c. Data on Scientific Collaborators	X				
d. Information on Inventions	X				
e. Technical Description of Project and Results	[redacted]				
f. Other *(specify)*					

2. Principal Investigator/Project Director Name *(Typed)*	3. Principal Investigator/Project Director Signature	4. Date
Robert M. Nerem	(	7/22/88

NSF Form 98A (1-87) Supersedes All Previous Editions

Form Approved OMB No. 3145-0058

FINAL REPORT ON

NSF TRAVEL GRANT INT-8796216

ENTITLED

ARTERIAL FLUID DYNAMICS

ROBERT M. NEREM, Ph.D.

SCHOOL OF MECHANICAL ENGINEERING

GEORGIA INSTITUTE OF TECHNOLOGY

ATLANTA, GA 30332-0405

404/894-2768

JULY 1988

This collaborative research effort was initiated at the University of Houston under NSF Travel Grant INT - 8414953. The total award was $3300, and when the Principal Investigator relocated to Georgia Institute of Technology, the grant was transferred to Georgia Tech. The current grant number at Georgia Tech is INT-8796216, and the amount of the award transferred was $2100. None of these funds were spent.

The grant was awarded to fund travel to Germany so as to facilitate a collaboration with Professor Dieter Liepsch in Munich. Unfortunately, the collaboration has been somewhat slowed for the last year and a half both because of the move to Georgia Tech and because Professor Liepsch has been on leave from his institution in Munich. This project involves obtaining measurements of arterial velocity in model arteries made from animal and human casts. The studies will be conducted using laser Doppler anemometry (LDA) to conduct detailed measurements of the fluid dynamic characteristics of flow in such geometries over a variety of conditions.

The main effort to date has been to construct flow casts of human coronary arteries. These have been made from anatomical casts provided by Dr. W. A. Seed in London, England. Two casts have already been successfully made and two others are now under construction, to be completed within a few months. During Dr. Nerem's visit to Munich, the technique for constructing these casts as applied specifically to coronary arteries was developed and the overall design of the experimental study was agreed upon. It is expected that experimental measurements will commence during the fall of 1988.

The reason that none of the funds awarded to Georgia Tech was spent is because Professor Liepsch was on leave from his institution in Munich. Just recently Professor Liepsch accepted an appointment at the Eisenhower Medical

Center in Rancho Mirage, California. He will be there for at least three years. The collaboration will continue, and the remaining, unspent funds at Georgia Tech are not needed since both collaborators are now in the United States.

It should be emphasized that, though both collaborators are now on this side of the Atlantic Ocean, the award of this grant was extremely important to the initiation of this cooperative effort. Without this award, the one trip to Munich would not have been made, and the models would not have been constructed, since the technology for this construction was more readily available in Munich.

With the models now constructed, we will proceed with the LDA velocity measurements. These measurements should provide considerable insight into the fluid dynamic phenomena present in the human coronary circulation. Combined with computer studies, we expect to learn more about such features as branching and curvature effects, velocity patterns, and flow separation. All important in this will be the effect of unsteady, pulsatile flow. Knowledge of such phenomena is important not only from the viewpoint of basic fluid dynamics, but also in determining the role of fluid dynamics in arterial disease.